College) have been appointed Demonstrators in the Cavendish Laboratory of Experimental Physics.

The University Commissioners have at last put forward a Statute by which students in "Letters" are to have a Doctorate, so that to Divinity, Law, and Medicine, two new faculties are now added, namely, Letters and Science. The University is also to have power to accept as an affiliated college any college in the British dominions, educating principally adult students, and to allow their qualified students three terms of residence towards those required to obtain a Cambridge degree.

The Woodwardian Professor gives notice that as he is prevented by illness from returning to Cambridge at present, Mr. Roberts, D.Sc. [Lond], will lecture for him during the present term.

THE returns already received for the Technological Examinations of the City and Guilds Institute show that over 1,100 candidates will present themselves for examination at eighty centres. This is a very large increase on last year, when only 202 were examined. The examinations are to be held on the evening of May 12, concurrently with the examination of the Science and Art Department on that evening.

SCIENTIFIC SERIALS

THE *Quarterly Journal of Microscopical Science*, April.—W. T. Thiselton Dyer, M.A., Assistant-Director, Kew, on the coffee-leaf disease of Ceylon (six plates).—J. D. Siddall, on Shepheardella, an undescribed type of marine rhizopoda (on the plates Shepheardia), with two plates. The nucleus in this form seems to be unlike anything as yet described among the rhizopods. The author also figures and describes *Lieberkuehnia wageneri* from Tenby. This rhizopod is only "a native of Berlin" in a very peculiar sense. Claparede's words are, "Nous n'avons rencontre qu'une seule fois ce rhizopode, a Berlin dans une petite bouteille qui renfermait de l'eau de provenance inconnue." The present memoir throws no new light on its probable affinity to *Pamphagus mutabilis*.—A. Sedgwick, on the development of the kidney in its relation to the wolffian body in the chick (with two plates).—F. M. Balfour, notes on the development of the Araneina (with three plates).—Dr. L. Waldstein, a contribution to the biology of bacteria.—Prof. Schafer, some teachings of development.—Prof. T. Jeffery Parker, on the histology of *Hydra fusca*.—Prof. Giard, on the Orthonectida, a new class of the phylum of the worms (with a plate).—Notes and memoranda.

American Journal of Science, March.—On a chart of the magnetic declination in the United States, constructed by J. E. Hilgard.—The old river-beds of California, by J. Le Conte.—Age of the Green Mountains, by J. D. Dana.—On a new action of the magnet on electric currents, by E. H. Hall.—Measures of the polar and equatorial diameter of Mars, made at Princeton, New Jersey, U.S., by C. A. Young.—On the use of the sine-formula for the diurnal variation of temperature, by B. A. Gould.—On the chemical composition of the Uraninite from Branchville, Conn., by W. J. Comstock.—On the mean free path of a molecule, by N. D. C. Hodges.—On the western limits of the Taconic system, by S. W. Ford.—Principal characters of American Jurassic dinosaurs, by O. C. Marsh. Part iii.

THE *American Entomologist*, No. 3, new series, March, 1880, contains a multitude of useful notes on questions concerning entomology, amongst which may be noticed trapping the Carpet Beetle (*Anthrenus scrophulariæ*).—The Ailanthus silkworm.—Insects injuring the black locust.—The insect enemies of our small fruits, by A. S. Fuller.—The relation between insects and plants, and the consensus in animal and vegetable life, by L. F. Ward.—Birds *v.* insects, by the late E. Perris, translated.—Two days collecting in the Mammoth Cave, with contributions to a study of its fauna, by H. G. Hubbard, the latter especially interesting, giving a list of all the animals hitherto found in this celebrated cave, highly illustrated by excellent woodcuts, with a description of a very curious new form of pseudo-scorpion, described by Dr. Hagen as *Chthonius packardi*. It will be a great advantage if the editors of this periodical give in future a *resume* of the contents of each number. We are requested to notice that it is now published by the Hub Publishing Company of New York, 323 Pearl Street.

Journal of the Franklin Institute, March.—The Edison electric light (continued), by Mr. Outerbridge.—Committee's report on the Goodwin mowing-machine.—Saws (continued), by Dr. Grimshaw.—Apparatus for illustrating the aberration of light, by Prof. Tobin.—On the acid products of combustion of coal, by M. Vincotte (translation).—Mica, by Mr. Rand.—A new lecture experiment; the cupelling of gold and silver.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 8.—"On the Sensitive State of Vacuum Discharges. Part II." By William Spottiswoode, D.C.L., LL.D., Pres.R.S., and J. Fletcher Moulton, late Fellow of Christ's College, Cambridge.

This paper forms a sequel to that published under the same title in the *Phil. Trans.*, 1879. It describes a continuation of the research into the nature and laws of the disruptive discharge, or electric spark. The methods of the earlier paper have been extended, and others adapted to the new circumstances have been devised, in order to carry the investigation into high vacua. In particular, independent sources of electricity have been used for effecting the discharge, whether in the sensitive or in the non-sensitive state; and the results have been confirmatory of the conclusions derived from the more limited means formerly described. Further, the effects of various tubes containing discharges in the sensitive state upon a tube containing a discharge in the non sensitive state have been observed and compared; and the tube so used as a test has been called the standard tube, and the method of its use the standard tube method. By this means, principally, the laws of the discharge in comparatively moderate vacua have been extended to high vacua.

In the higher vacua, the phenomena of molecular streams, and the phosphorescence consequent on them, that have been studied and described by Mr. Crookes, present themselves. These derive great importance for the purposes of the present paper from the fact that in high vacua the ordinary luminous discharge becomes so feeble in appearance that it is often difficult to observe. Under these circumstances the phosphorescence, which, like the ordinary luminous effects, may exist either in a sensitive or in a non-sensitive state, forms the best index of what is going on within the tube. Much information as to the nature and procedure of the discharge may be derived from the mode of interference of one molecular stream with another, from the direction and character of shadows cast by these streams, and by a form of interference which has here been called that of virtual shadows.

The conditions of pressure and of electrical violence, under which phosphorescence is produced, have been carefully studied; and it has been found that, with a suitable adjustment of the discharge, the phenomena are not confined to high vacua, but can be obtained under pressures much exceeding those of ordinary vacuum tubes. The phenomena of these molecular streams have also been compared with those exhibited by the projection of finely divided solid conducting matter when heaped up over the negative terminal, with the view of ascertaining the nature of the phenomenon and its position in the discharge.

At the close of the paper the authors have discussed some of the general conclusions which they think may be fairly drawn from their present researches. First, as to the relative order of magnitude of the time-quantities entering into the discharge; *e.g.*, the times occupied by the discharge of positive or negative electricity, or of molecular streams, in leaving a terminal; the time occupied by the same elements in passing along the tube, &c. Secondly, as to the durational character of the negative as compared with the positive discharge, which appears to increase with the degree of exhaustion. Thirdly, as to the mode of formation of the positive column; and fourthly, as to the relation of the molecular streams to the discharge proper.

But for the details of these conclusions the reader must be referred to the paper itself.

April 15.—"Description of some Remains of the Gigantic Land-lizard (*Megalania prisca*, Owen) from Australia. Part II.," by Prof. Owen, C.B., F.R.S.—Referring to a former Part (*Phil. Trans.* 1858, p. 43), the author gives, in the present, descriptions of subsequently received fossils of *Megalania prisca*, advancing the knowledge of that species of large extinct lizard. Characters of the dorsal, sacral, and caudal vertebræ, with those of a considerable portion of the skull, are detailed. So much of the upper jaw as is preserved shows the species to have had that part sheathed with horn as in the tortoise. Upon the head were

seven horns, three in pairs, and one single; they are defined as the "supraparietal," "supratemporal," and "post-orbital" pairs; the single and symmetrical horn is "nasal."

In the comparison of this character with the known genera of lizards the author finds the closest correspondence in the diminutive existing Australian species, *Moloch horridus*, Gray. He concludes with remarks on the probable habits and conditions of extinction of the subject of his two papers.

"Report on the Exploration of the Caves of Borneo," by A. Hart Everett. "Introductory Remarks," by John Evans, D C.L., LL.D., Treas. R.S. And "Note on the Bones Collected," by G. Busk, V.P.R.S.

The general result of the exploration may be summed up as follows:—The existence of ossiferous caves in Borneo has been proved, and at the same time the existence of man in the island with the fauna, whose remains are entombed in these caves. But, both from the recent nature of this fauna, and from the fact that the race of men whose remains are associated with it had already reached an advanced stage of civilisation, the discovery has in no way aided the solution of those problems for the unravelling of which it was originally promoted. No light has been thrown on the origin of the human race—the history of the development of the fauna characterising the Indo-Malayan subregion has not been advanced—nor, virtually, has any evidence been obtained towards showing what races of men inhabited Borneo previously to the immigration of the various tribes of Malayan stock which now people the island. Furthermore, the presumption that the north-west portion of Borneo has too recently emerged above the waters of the sea to render it probable that future discoveries will be made of cave deposits of greatly higher antiquity than those already examined, has been strengthened. Under these circumstances it seems advisable that cavern-research in north-west Borneo should now be left to private enterprise, and that no further expense should be hazarded, at any rate until the higher parts of the island in the north-east may be conveniently examined.

"Note on the Collection of Bones from Caves in Borneo, referred to in Mr. Everett's Report on the 'Exploration of the Bornean Caves in 1878-9,'" by George Busk, F.R.S., V.P. Anth. Inst.

These bones present nothing of especial interest; and with respect to the race to which they may have belonged, the information they have afforded is very meagre. On this point all that can be said is that they may well have belonged to the Malay type, but there is also no apparent reason why they should not have been of Chinese origin. What tends to afford some support to this supposition is the marked fulness or bulging of the squamosal in the sphenoidal fossa, to which I have called attention, and which, upon examination of the collection of crania in the Royal College of Surgeons, I find is presented by several among the Chinese crania in a more marked degree than in the other races to which my attention was directed.

Physical Society, April 10.—Prof. Fuller in the chair.—New members:—Mr. W. O. Smith, Prof. Judd, F.R.S.—A paper on the human eye as an automatic photometer, by Mr. William Ackroyd, was read. It is difficult to get the value of a very intense light in terms of a weak one, because the relative physiological values of the similarly coloured constituents are unknown. The author's experiments were made to show that the eye itself is a fairly good light measurer. When a "spot" or star of light is looked at from a distance, it is seen to emit "rays" or spokes of light at all angles. These are due to the radiate structure of the crystalline lens and to the lachrymal fluid on the surface of the corner of the eye. The rays are of varl us lengths and are shorter in the 1st and 2nd quadrants, next the nose, near the blind spots, than on the 3rd and 4th quadrants—a fact probably due to the insensibility of this region. The iris expands and contracts under the stimulus of light independently of the will; and both irises act sympathetically. Now the iris lies between the seats of irregular refraction, and thus any change in the size of the pupillary aperture will be rendered evident by an alteration in the length of the longer rays of a spot or point of light. On this fact is based the use of the eye as an automatic photometer. The sensitiveness of the iris varies in different persons. The author finds that a sperm candle, burning 120 grains per hour, produces a distinct movement of his iris when 14 yards distant. In employing the eye as a photometer, the author adopts the principle that if the light from one source A falling on the eye is capable of producing movement of the iris at a distance *d*, and the light from a different source B is capable of producing the same movement at the distance *d'*, then the relative intensity is proportional to the squares of these distances. To carry this out in practice the observer is in the dark, and an artificial star is placed on a level with the eyes at a fixed distance. Below this is placed the light to be tested in the same plane. While gazing steadily at the star the other light is to be eclipsed and revealed, and the observer is to find a position where the revealing of the second light does not influence his iris, as shown by no apparent shortening of the rays of the star taking place. He then approaches gradually till a second position is reached, when the revealing of the second light *does* produce a movement of the iris. The distance between his eye and the light, *d*, is measured. A third light is now put in place of the second, and the same observations repeated, so as to get a second distance, *d'*. From these distances the relative intensities are calculated; the author's results agree pretty closely with Rumford's photometer, but he found that for some reason the two first observations have to be discarded as too inaccurate. Owing to the sympathy between the two irises these experiments were binocular. This sympathy may prove convenient in constructing an eye-photometer, since one eye can be turned to the light to be estimated while the other is looking at the artificial star. This method of photometry would be too delicate for comparing powerful electric lights, unless aided by mechanical means.—Prof. Ayrton then offered an explanation of the experiment shown by Prof. Guthrie at last meeting to the effect that while flannel rubbed with ebonite was + electrified, and ebonite rubbed with glass was +, flannel rubbed with glass was −. Prof. Ayrton accounted for this apparent anomaly on the ground that one or more of the substances was an electrolyte. Glass, for instance, is an electrolyte, and a battery had been made from it. Experiments made by Prof. Perry and himself had shown that in a "pile" made up of divers substances, one or more of which were electrolytes, though the rest were metals, the electromotive force of the pile was equivalent to the algebraical sum of the several "pairs" composing it, but it was *not* equivalent to the electromotive force of the first and final plates made into a pair. That could not be predicated from the contact-electromotive forces of the elementary "pairs." When only metals were employed it could, but not in cases where an electrolyte entered. This same result would apply to Prof. Guthrie's frictional experiments. In answer to Prof. Guthrie's question whether electrolysis did not come into play in Prof. Ayrton's experiments, Prof. Ayrton replied that it could not operate to a greater extent than in Prof. Guthrie's experiments, as he had used a quadrant electrometer.—Dr. Stone then described a new tonometer devised by Prof. Rudolf Konig, which he had recently seen in Paris. It consisted of a clock-work working into a tuning-fork, which produced no less than 128 escapes per second. To this clock-work, originally invented by an assistant of M. Breguet, and exhibited at the Paris Exhibition of 1856, Prof. König had added a Helmholtz vibration microscope moved by the clock and the fork, whose vibration number to be measured is placed vertically in the focus of the microscope. The tonometer is very portable, and no loading of the fork is required. Prof. Hughes observed that he had patented a vibrating regulator in 1856.—Dr. Guthrie then exhibited an electric machine formed of a collodion disk rubbed with a cat's fur, and giving negative sparks. The collodion, after a suggestion of Capt. Abney, was put on by giving a disk a coat of collodion, then a coat of india-rubber dissolved in benzol, then a coat of collodion again. Prof. Guthrie also showed that an iron cylinder revolving round its longer axis, and with a current flowing in a wire parallel to it, has power to deflect a magnetic needle. Prof. Ayrton stated that he had found the mere rotation of an iron cylinder produced the deflection in question, and therefore thought the current was not required to produce the effect shown.

PHILADELPHIA

Academy of Natural Sciences, November 11, 1879.—On a collection of crustacea from Virginia, North Carolina, and Florida, with a revision of the genera of Cragonidæ and Palæmonidæ, by J. S. Kingsley.

November 18.—On the stratigraphical evidence afforded by the Tertiary fossils of the Peninsula of Maryland, by Angelo Heilprin.

December 9.—Description of a fœtal walrus, by Dr. Harrison Allen.—Complete connection of the *Fissura centralis* (fissure of Rolando) with *Forsa sylvii*, by Dr. A. J. Parker.

December 30.—Annual meeting.—Dr. Ruschenberger, the president, gave a *résumé* of the Society's work, describing it not as an exclusive but as an inclusive Society for the acquirement, increase, simplification, and diffusion of natural knowledge. Its members have signalised themselves by doing their own printing in the Academy Hall; in fact gratuitous labour produces all the matter published by the Academy. The institution is free from debt, with a substantial building, and large collections of objects as yet little studied. During last year the card catalogue of works on anatomy and physiology has been completed, and the only departments of the library not yet possessing a special catalogue will be those of anthropology and mineralogy; these it is hoped to complete this year. In the museum work Mr. J. A. Ryder has now identified 700 species of fishes in 325 genera. The museum has had a notable acquisition in the archæological collections of the American Philosophical Society, especially consisting of the Poinsett collection of Mexican antiquities, and many Peruvian remains; while Mr. W. S. Vaux has borne the expense of adapting a room to receive the collection. The skeleton of a native of the Chatham Islands has been presented by Mr. W. H. Rau. Many fossils of great interest and value, including bones of Uintatherium, Palæosyopæ, and Crocodile, from Green River, Wyoming, have also been added. The Section of Biology and Microscopy has had two special *soirées* and seventeen meetings. In Conchology 2,750 trays, containing 11,895 specimens, have been determined, labelled, mounted, and placed in the collection. The arrangement of the Swift Collection is now completed, after three years' labour; it is especially rich in West Indian shells, and especially in terrestrial species; it comprises 7,058 trays, containing 30,384 specimens. Mr. C. F. Parker has been a very active worker in this department, and Mr. John Ford, vice-director of the section, has prepared sections of many shells to show their internal form. Donations have been very numerous and valuable. The Herbarium has received very valuable donations, and the gaps in the genera are now mostly from rare districts. Dr. Asa Gray has during the year revised many perplexing genera in the North American Compositæ, and Mr. Parker is mounting the plants, with Dr. Gray's notes affixed, as fast as elaborated. There is great and valuable voluntary work going on by many botanical workers; 2,181 species have been received during the year, especially 623 species of Florida plants, including many new and rare species collected and presented by Dr. A. P. Garber, and many hundreds of foreign plants, by Dr. Asa Gray.

PARIS

Academy of Sciences, April 19.—M. Edm. Becquerel in the chair.—The following papers were read:—On the inverse problem of motion of a material point on a surface of revolution, by M. Resal.—On the reciprocal displacements of the halogen elements, by M. Berthelot.—On the stability of oxygenated water, by M. Berthelot. The spontaneous decomposition of this compound becomes slower and slower in course of time. The rate of transformation varies remarkably with the presence of foreign substances in the liquor. The least trace of a base or free alkali causes rapid decomposition; acids retard the process; variation in amount of acid hardly affects it, but the special nature of the acid does. Temperature accelerates the process. —On the earths of samarskite, by M. Marignac. He confines himself here to those earths the nitrates of which are last decomposed. To separate these he had recourse to their difference of solubility in a saturated solution of sulphate of potash. He finds, then, yttria (the principal element), terbine, a new earth Y_α, and a small quantity of oxide of didymium, and of an earth, which, if not pure decipium, is at least in great part composed of it.—On the interoceanic canal of Panama, by M. de Lesseps. No serious difficulty is anticipated. The length of the canal will be 73 km., while the Suez Canal is 162. From the Atlantic the entrance will be by the mouth of the River Chagres (which will be deepened), and at Cruces, where this river issues from the mountains, a dam of 46m. height will be raised, making possible the storage of 1 milliard cubic metres of water. Beyond Cruces the canal traverses the mountain of Culebra by a cutting of 5km., and then the bed of the Rio Grande is utilised to the Bay of Panama.—Observations on Megapoda, by M. Oustalet. He gives results of a visit to the English and Dutch museums; thinks the number of species allowed by ornithologists too large and reducible to about twenty-five; proposes a new subdivision of the genus *Talegallus*, the sub-genus *Aepypodius*, including the *T.* of Waigiou (which he calls *T. Bruijnii*), and *T. pyrrhopygius*; he also seeks to rectify the frontiers assigned to Peristeropoda by Huxley.—Theory of capillary phenomena (5th memoir), by M. Roger.—On the electromagnetic gyroscope, by M. de Fonvielle. The impossibility of getting rotation with induction-coils whose induced wire was very long, and in which therefore the difference referred to by M. Jamin was as great as possible, led him to reject M. Jamin's explanation.—Discovery of a comet by M. Schaberle (telegram from the Smithsonian Institution), communicated by Admiral Mouchez.—Observations of the same comet at Paris Observatory, by MM. Henry and Bigourdan.—On the positions of the principal planets, by Mr. Chase.—Remarks on the formulæ of quadrature of Gauss, by M. Radau. —Electric synchronism of any two motions, by M. Deprez. He transmits electrically the movement of a motor A to a receiver B, so that the angular velocity of B is always equal in amount and sign to that of A. The transmitter has two commutators for inversion of current, and the receiver two straight electromagnets which rotate between the branches of a fixed one.—Measurement of thermo-electric electromotive forces in contact of a metal and a liquid, by M. Bouty. A derivation from a circuit of known resistance, traversed by the current of one Daniell element, comprised (1) a thermoelectric apparatus, formed of two tubes containing a liquid kept at different temperatures, and two metallic plates of the same metal, the tubes being connected by a long capillary syphon; (2) a sensitive Lippmann electrometer. The results with various metals and salts of these in water-solution, where the warm metal is exteriorly the positive pole, are tabulated. The thermo-electric force is rigorously proportional to the difference of temperature of the plates, and does not sensibly vary with the degree of dilution of the salt. Salts of a given oxide give nearly the same number, and the number for copper and amalgamated zinc are nearly identical. Where the cold metal is exteriorly the positive pole, the measurements become uncertain, and the variations of electromotive force are no longer proportional to the temperature.—On an automatic mercury pump, by M. Couttolene. This is for increasing a vacuum commenced by a water-trompe.—On tropeins, artificial mydriatic alkaloids, by M. Ladenburg.—On gelose, by M. Morin.—On carbonate of ammonia, by M. Maumerle. Two samples, nearly identical, showed very different properties. —On existence of ammonia in plants and muscular flesh, by M. Pellet. *Inter alia*, the strong ammoniacal odour perceived in sugar manufacture, when the juice is treated with lime, is accounted for by the ammonia found in beet. Plants containing much of alkaline phosphates (*e.g.*, corn) have their carbonates decomposed by these. In flesh of ox M. Pellet found 0·15 gr. ammonia per cent. of the substance.—On an adulteration of silicate of soda, by M. Jean. Anhydrous soap was the substance added.—On the variability of the teats of Ovides of the Lower Cevennes, by M. Tayon.—On treatment of Arabian elephantiasis by simultaneous use of continuous and intermittent currents, by MM. Moncorvo and Aranjo. The continuous currents soften the tissues, and the intermittent promote reabsorption.

CONTENTS